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Respected Sir/Mam,

I am enclosing herewith a CASE REPORT manuscript titled “Rehabilitation of Maxillary Anterior Tooth Spacing Using Digital Smile Designing with IPS e.max Laminate Veneers: A Case Report ” for possible evaluation in your esteemed journal.

With the submission of this manuscript, I would like to undertake that the above-mentioned manuscript has not been published elsewhere, accepted for publication elsewhere or under editorial review for publication elsewhere; and that my Institute’s [Department of Prosthodontics and Crown & Bridge, Dr. R. Ahmed Dental College and Hospital, 114. A.J.C. Bose Road, Kolkata-700014, West Bengal] representative is fully aware of this submission.

Thanking you,

Yours’ sincerely,

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Research Article

Rehabilitation of Maxillary Anterior Tooth Spacing Using Digital Smile Designing with IPS e.max Laminate Veneers: A Case Report

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Abstract:

IPS e.max, a lithium disilicate glass-ceramic, exhibits outstanding esthetic and mechanical properties, including superior translucency, flexural strength, and long term durability. These characteristics render it particularly advantageous for conservative, minimally invasive restorations in the anterior maxillary region, where both esthetics and function are critically important. This case report presents the comprehensive prosthodontic management of maxillary anterior spacing with Digital Smile Designing software using IPS e.max ceramic veneers. The treatment was meticulously planned with the aid of Digital Smile Designing (DSD), a contemporary tool that enhances diagnostic accuracy, facilitates interdisciplinary communication, and allows for precise visualization of the proposed esthetic outcome. Through this digital workflow, a patient-specific, predictive, and minimally invasive approach was developed to achieve optimal diastema closure while preserving the integrity of natural tooth structure and maintaining harmonious dental proportions. The final result demonstrated excellent integration with adjacent dentition, superior esthetic outcomes, and high patient satisfaction. This case underscores the clinical efficacy of combining Digital Smile Designing with lithium disilicate veneers to achieve a predictable, conservative, and esthetically pleasing solution for anterior spacing. [Keywords: Lithium Disilicate, Ceramic Veneers, Digital Smile Design, Spacing Closure, Minimally Invasive Dentistry]

1. Introduction:

Achieving predictable and long-lasting outcomes in esthetic dentistry requires not only technical precision but also a comprehensive understanding of the underlying etiology behind dental anomalies. One such common clinical challenge is the presence of spacing in the maxillary anterior region, which can significantly impact both facial esthetics and patient confidence. These interdental spaces whether congenital, developmental, or acquired-must be addressed through a systematic, evidence-based approach that considers the biological, functional, and aesthetic aspects of treatment.

Anterior tooth spacing, particularly in the maxillary region, poses a unique challenge due to its high visibility and direct influence on smile esthetics⁵. Whether arising from developmental, periodontal, or pathological causes, these spaces require a thorough prosthodontic evaluation and a carefully designed restorative plan.

In prosthodontics, the emphasis lies in achieving optimal esthetic integration while preserving the health and integrity of the remaining tooth structure^{14,15}. Modern prosthodontics emphasizes not only the closure of diastemata but also the establishment of harmonious tooth proportions, incisal symmetry, and gingival architecture^{14,15}. The integration of Digital Smile Designing (DSD) into the diagnostic and planning phase allows clinicians to visualize and simulate the proposed esthetic outcome with high accuracy. DSD facilitates enhanced communication between the dental team and the patient, ensuring shared decision making and greater predictability in the restorative outcome^{8,13}. Facial and dental analyses, performed through digital workflows, aid in aligning restorations with the patient's unique esthetic parameters, such as smile line, lip dynamics, and midline orientation and proportions of the face and the individual tooth.

Soft tissue contour and health play a vital role in enhancing the visual appeal of restorations. Procedures aimed at improving gingival architecture, such as crown lengthening, may be necessary in selected cases to establish proper tooth proportions and harmonious gingival symmetry. In the context of minimally invasive dentistry, ceramic laminate veneers particularly those fabricated from lithium disilicate materials, such as IPS e.max - offer an ideal solution due to their superior aesthetics, translucency, strength, and ability to bond reliably to enamel substrates^{1,7,9}.

This case report presents the prosthodontic management of maxillary anterior tooth spacing using IPS e.max veneers. It highlights the clinical decision-making process, material selection, and execution of a minimally invasive restorative approach that resulted in a highly esthetic and functionally stable outcome.

2. Case Report:

A 26-year-old female reported to our institute Dr. R. Ahmed dental college and hospital, Kolkata in department of prosthodontics and crown and bridge, with the complaint of spacing in maxillary front region and unaesthetic appearance. Intra-oral examination reveals spacing of 2 mm in between lateral incisor and central incisor and canine bilaterally. The probing depth of 2 mm was noted with no gingival recession. Clinically there is no enamel hypoplasia or craze lines found on the enamel of the corresponding tooth. No Tetracycline stains, tooth fracture or previous restoration and mobility noted. The patient is having a gummy smile. The patient had bilateral Class I molar relation with normal overjet and overbite anteriorly. On mandibular movements it was noted that the patient was having canine guided occlusion. On protrusive movement of the mandible there is an edge to edge incisal relation of the maxillary and mandibular anterior tooth. Marginal gingival in the anterior maxillary region shown no sign of inflammation. Radiographic examinations were done to eliminate other probable etiology. Both central incisor and canine bilaterally shows no sign of pathology both clinically and radiologically. (Figure 1,2,3,4)

Figure 1: Pre-Operative View (E/O)

Figure 2: Pre-Operative View (I/O)

Figure 3: Pre-Operative Radiographic View Figure 4: Pre-Operative View (I/O)

Figure 5: Pre-Operative View (I/O)

The treatment options given to the patient were orthodontic closure of space, direct restoration by composite resin, and porcelain laminate veneers(PLV). The patient opted for the Porcelain laminate veneers due to its conservative approach, more esthetically pleasant and short duration of treatment.

The diagnostic impressions were made using irreversible hydrocolloid impression material (Algingum: Prime dental product Pvt Ltd.) and poured with Type III dental stone (BNSTONE: B N CHEMICALS), and the study casts was retrieved for treatment planning. study cast was used for the diagnostic mock-up of the maxillary central incisors and lateral incisors. It was explained to the patient that restoring both the central incisors and lateral incisors bilaterally will achieve a harmonious and proportionate appearance.

After getting the consent from the patient the digital smile designing was done using the DSD software (PROTEETH AI) on Tablet(iPad). The results of the digital smile designing was achieved by maintaining the prosthetic consideration and golden proportion and the harmony with the surrounding structures. The digital mock up was shown to the patient to show the real time change virtually by means of the tooth shape, size and shade following treatment and necessary changes were done according to the patient's acceptance(Figure 6). Prosthetic restoration was planned in tooth number 11,12,21 and 22. Tooth number 11 and 21 were added in the restoration to maintain the proportions of the restoration as the patient is having a gummy smile.

Figure 6: Digital Smile Designing

The treatment plan was finalized that restoring both the central incisor and lateral incisor bilaterally by Porcelain Veneer will be necessary to achieve the treatment outcome. The

incisal edge overlapping design of the veneer was finalised due to the edge to edge bite of the patient during the mandibular protrusive movement and the palatal butt end was given to give strength to the ceramic veneer. The depth of the veneer preparation was done 0.5 mm as there was no need to change the tooth shade. The patient was satisfied with the natural tooth shade.

Informed consent was taken prior to treatment that explained the benefits, drawbacks, and complications associated with the treatment.

Shade selection was done using VITA Toothguide 3DMASTER before preparation.

The final preparations were then started for the ceramic veneers on 11,12,21 and 22 using tapered chamfer and depth cutting diamond bur. The depth of the preparation was limited to 0.5 mm. Mesially and distally the proximal preparation was extended beyond the mesial and distal transitional line angle but not involving the marginal ridges palatally. Preparation design involved the incisal overlap to end on palatal butt joint. Butt joint was kept 2 mm away with the occluding surface of the mandibular incisor to the palatal surface of the maxillary incisors. The final impression was then made with putty and light body addition silicone impression material (Photosil:DPI) (Figure 7 and 8).

Figure 7: Final Tooth Preparation

Figure 8: Final Silicone Impression

The DSD done previously with DSD software on iPad is transferred to the lab. Lab made the design on CAD software by taking the DSD outcome as reference. CAD-CAM fabricated wax try-in was done before fabricating the final prosthesis to check the design,

the proportions and the fit of the prosthesis. (Figure 9 & 10).

Figure 9: Wax Try-in (Labial View) Figure 10: Wax Try-in (Palatal View)

After try-in was approved, lab fabricated the Porcelain laminate veneering(PLV).

Try in of the PLV were done using the try in transparent gel (TopCEM Try-in gel :HUGE) and was evaluated for the overall contour, size and shape, the adjacent contacts and fit, palatal smooth finish line and any shade change with try-in gel. The patient's approval was taken with respect to size and shape and shade of the ceramic veneer (Figure 11& 12)

Figure 11: Bisque Try-in (Labial View)

Figure 12: BisqueTry-in (Palatal View)

The cementation of veneers was then started with the 11 and 12 first and the 21 and 22 respectively. The adjacent teeth were isolated with mylar strips to protect from the etchant. The ceramic veneer was etched with porcelain etch (9% Buffered Hydrofluoric Acid- Waldent Procelain Etch) for 90 seconds followed by 5 mins of Ultrasound cleaning. The 11,12,21,22 tooth is etched (Ivoclar Vivadent Eco-Etch) for 30 secs followed by 15 sec washing with water. Bonding agent (5th gen) is applied to the prepared tooth surfaces with fresh applicator tips. Silane Coupling agent (Prevest Denpro Silane-X) was applied to the bonding surface of the ceramic veneers and let it dry. The luting resin cement (ColteneSolocem Transparent self-adhesive dual cure resin cement) was used to cement the ceramic veneers. 5 sec of light curing was done to have initial set of the cement. The excess cement was removed thoroughly around the veneers and from the gingival sulcus. After that final Curing was done by light curing machine for 40 sec on all the surfaces of the veneered tooth. Post- operative instructions were given to the patient. The patient was satisfied with the overall aesthetics and shade of the IPS e-max PLV. (Figure:13&14)

3.Discussion:

Maxillary anterior tooth spacing represents a frequently encountered aesthetic concern in adult patients, often prompting them to seek prosthodontic or esthetic rehabilitation. Defined as an interdental gap of 0.5 mm or greater, these spaces are most commonly observed in the anterior maxilla and may result from a range of developmental, anatomical, or pathological factors^{5,14}. Along with the gummy smile, the visibility of the tooth becomes more prominent which hinders the esthetics. Although such spacing may appear to be a primarily aesthetic issue, it can significantly impact phonetics, masticatory function, and psychosocial well-being.

A comprehensive evaluation of the etiological factors underlying anterior spacing is

imperative for accurate diagnosis and long-term treatment success. Common causes include discrepancies in tooth size or morphology, agenesis or microdontia of maxillary lateral incisors, and generalized spacing due to a mismatch between the size of the teeth and the arch. While physiologic spacing may self-correct during the mixed dentition phase following the eruption of permanent maxillary canines, residual spacing persisting into adulthood-particularly cases involving gaps exceeding 2 mm - typically warrants active intervention.

A critical component of the diagnostic and treatment planning phase involved the use of Digital Smile Designing (DSD). Through facially driven digital analysis, DSD enabled precise visualization of the patient's existing dental condition and simulation of the proposed restorative outcome. This digital workflow provided a reliable platform for evaluating tooth proportions, midline alignment, incisal curvature, and smile symmetry before initiating irreversible procedures. Importantly, the DSD process facilitated improved communication with the patient, allowing her to better understand the proposed esthetic changes and actively participate in the planning process. It also enhanced collaboration between the clinician and laboratory technician, ensuring that the final restorations were tailored precisely to the patient's facial features and esthetic expectations^{8,13}.

In the present clinical case, the patient demonstrated approximately 3-4 mm of spacing distally to maxillary central incisor with lateral incisors and canines bilaterally. A variety of treatment modalities were considered, including orthodontic space closure, direct resin composite build-ups, and indirect porcelain laminate veneers (PLVs). After a detailed discussion of the advantages, limitations, and prognosis of each option, the patient elected to proceed with PLVs, given their conservative preparation requirements, excellent aesthetic potential, and shorter treatment duration relative to orthodontic therapy.

Digital Smile Designing with Porcelain veneers are widely recognized as a highly effective modality for addressing aesthetic deficiencies in the anterior dentition. Compared to direct

resin restorations, veneers offer superior optical properties, long-term color stability, enhanced resistance to wear, and greater overall clinical predictability^{1,5,9}.

Among the available ceramic systems, lithium disilicate-based materials—particularly IPS e.max—have gained significant clinical acceptance due to their favorable mechanical properties, biocompatibility, and natural translucency. IPS e.max exhibits excellent flexural strength and fracture resistance, while simultaneously achieving high aesthetic outcomes due to its enamel-like light transmission^{1,7,9}.

In this case, four IPS e.max veneers were placed on teeth 11, 12, 21, and 22. The preparation design incorporated an incisal overlap, chosen based on clinical considerations including incisal edge integrity, anticipated load distribution, and the need for optimal aesthetic integration. The incisal overlap design was done as the patient was having edge-to-edge occlusion of the maxillary and mandibular anterior teeth in the mandibular protrusive movements. A palatal butt joint is incorporated to enhance the integrity of the porcelain veneers. The selection of veneer design significantly influences both the mechanical performance and longevity of the restoration.

Although Meijering et al. observed no statistically significant difference between preparations with and without incisal coverage³.

Smales et al. reported a notably higher survival rate (96%) for veneers with incisal coverage compared to those without (85%). This evidence supports the design rationale adopted in the present case. The depth of the preparation was limited to 0.5 mm to keep the preparation within the enamel itself and as there was no need to change the shade of the natural tooth, keeping the translucent veneer within the enamel will enhance the natural tooth shade of the patient⁴.

Calamia & Calamia (1994) advised a minimal reduction (0.3 mm cervically, 0.5 mm middle, 0.7 mm incisal) when some modification of anatomy or thickness is needed—but if no color change is required, “ultrathin” or “no-prep” options may be used to conserve enamel¹.

Magne & Belser (2002) in *Bonded Porcelain Restorations in the Anterior Dentition*, Stressed the importance of enamel preservation².

Peumans et al. (2000s) in Clinical studies and reviews on veneer longevity found that veneers bonded to enamel with minimal preparation (~0.3 mm) have better survival than those involving dentin or thicker reduction — especially when no major esthetic modification (such as shade change or shape change) is required⁵.

Fradeani (2007) – In Esthetic Rehabilitation in Fixed Prosthodontics recommends between 0.3–0.5 mm facial reduction for shade and shape correction, and 0.2 mm for purely surface adjustments⁶.

Jiakang Zhu et al(2022) in their study stated that bond strength to enamel is higher than to dentin, and higher percentages of preserved enamel translate to higher Shear bond strength and better clinical survival(20 MPa for enamel bonding and 10 MPa when bonding is entirely to dentin). Literature review and evidences matches with the preparation for this case as it was done entirely in on the enamel to have a better bond strength⁷.

As we were using the translucent dual cure resin cement for luting, the shade of the final veneer would not be affected by the luting cement.

The patient was satisfied with the final outcome of the prosthesis which was made by evidence based prosthetic desing along with real time virtual smile designing.

4.Conclusion:

The management of maxillary anterior tooth spacing necessitates a methodical approach encompassing accurate diagnosis, appropriate material selection, and meticulous attention to biomechanical and aesthetic considerations.

The incorporation of Digital Smile Designing played a pivotal role in enhancing the diagnostic precision and esthetic predictability of the treatment. By enabling digital visualization of the proposed restorative outcomes, DSD facilitated effective communication, improved treatment planning, and ensured that the final result harmonized with the patient 's facial features and esthetic desires^{8,13}. When combined with contemporary ceramic materials and conservative prosthodontic principles, digital

workflows such as DSD significantly elevate the standard of care, contributing to highly personalized and predictable outcomes in esthetic dentistry .

In this instance, IPS e.max porcelain laminate veneers provided a minimally invasive, highly aesthetic, and durable solution tailored to the patient's clinical and personal expectations^{1,7,9}.

5. Source of Funding

None.

6. Conflict of Interest

None.

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